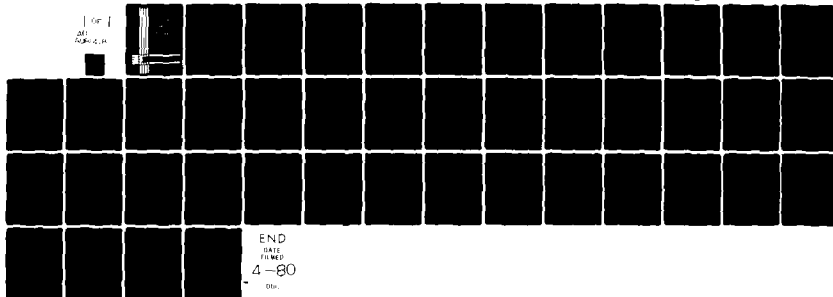


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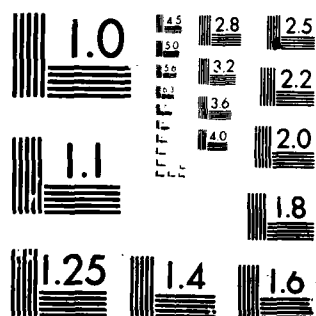
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INTRODUCTION

PURPOSE OF CATALOG

The Air Force Business Research Management Center (AFBRMC) is the Air Force's focal point for research about the acquisition process. Part of the AFBRMC's mission is to match acquisition problems with research capabilities. Therefore, this Research Topics Catalog has been developed to provide the academic, business, and Government research communities with a better understanding of the Air Force's needs for acquisition research. The catalog highlights specific research needs and objective statements. Attainment of the specific objectives is important to the overall improvement and effectiveness of the Air Force in acquiring and supporting major weapon systems. Research needs are focused on those issues, including long-term issues, which, if resolved, can aid significantly in the improvement of defense capabilities. The intent of the catalog is to increase the availability of Air Force acquisition research problems to possible researchers and to improve the quality of proposals received.

USE OF CATALOG AND PROPOSAL PROCEDURES

This catalog is organized to provide potential researchers a framework for reviewing the acquisition process, an appreciation of topics which need to be researched, and an understanding of the procedures for proposal submission. Please read the Management Overview section of the catalog before evaluating the individual research needs.

Individuals not affiliated with the Department of the Air Force may submit unsolicited proposals on any of the research needs stated in this document. However, before you submit an unsolicited proposal to the AFBRMC, we strongly encourage you to discuss your research approach and AFBRMC budgetary limitations with the AFBRMC's point of contact, who can be contacted by calling Area Code (513) 255-6221 or Autovon 785-6221.

Although Air Force employees who are students or faculty at various academic institutions are not required to make formal proposals, we encourage them to discuss the research topic with the AFBRMC's point of contact for additional information and assistance.

An unsolicited proposal should include the following information:

1. Name and address of the researcher.
2. Organizational affiliation.
3. Concise title and abstract of the proposed research and a statement indicating that the submission is an unsolicited proposal.
4. Discussion of each of the following:
 - a. Purpose and scope of the research.
 - b. Problem statement.
 - c. Proposed methodology.
 - d. Projected benefits.
 - e. Suggested research timetable (start and completion dates).
 - f. Estimated budget to include cost of personnel, travel, computer time, overhead, etc.

5. A statement as to whether the proposal has been or is planned to be submitted to other Air Force Government agencies.
6. Resume of principal researchers to include educational background and experience.

Researchers are encouraged to submit proposals that are accurate, clear, and sufficiently detailed to allow for a meaningful evaluation. Primary proposal emphasis should be placed on research scope and methodology.

As you read through the pages that follow, you may see research topics for which your organization can contribute to the achievement of a specific research objective. If such is the case, you are invited to discuss the topic further with the AFBPMC's project manager of that topic. Furthermore, you may have a new idea not considered in this document. We welcome any new concept which would improve the Air Force's capability.

It should be understood that this document is furnished for information and general guidance only; it is not to be construed as a request for proposals or as a commitment by the Government to issue a contract.

Comments or suggestions for improving the Research Topics Catalog or specific individual needs are encouraged. They should be directed to:

Air Force Business Research Management Center/RDCB (Capt Gross)
Wright-Patterson AFB, OH 45433

MANAGEMENT OVERVIEW

MISSION

The Air Force Business Research Management Center (AFBRMC), established at Wright-Patterson AFB in July 1973, is the Air Force focal point, under Air Force Regulation (AFR) 20-5, for contracting/acquisition-related research studies. Operating under the functional guidance of the Director of Contracting and Acquisition Policy, HQ USAF, the AFBRMC matches acquisition problems with existing research capabilities, manages and monitors selected research efforts, tests research results, and, when warranted, assists in implementing resulting recommendations for improvement. The AFBRMC also consults with management to help it use contracting and acquisition research results.

AFBRMC RESEARCH PROGRAM

In order to provide a framework for conceptualizing the contracting/acquisition process, the AFBRMC has defined the following "acquisition practices:"

Requirements Management - Processes of establishing needs to be satisfied by acquisition from the private sector of our economy.

Business Relationship - All processes involving the establishment of business management plans, contractual relationships, and the alignment of specific Air Force functions involved in establishing a business relationship with the private sector.

Program Management - The processes of planning, organizing, and controlling internal Air Force activities to insure that contracted program needs are satisfied.

Acquisition Logistics - All processes related to the provision of life cycle systems support.

Business Environment - Those aspects of our contracting/acquisition process which are designed to permit us to accommodate conditions which arise externally and over which we have no direct control.

These research practices are divided into research areas and further subdivided into individual research topics throughout the catalog. For each area the objective and background statements are provided. The purpose of the area description is to provide a potential researcher with an understanding of the general environment before he reviews the specific need. It is important, therefore, that each research area be reviewed before review of individual topics.

Each topic is presented with the objective and background statement. All the topics are listed by area and within that area are ranked in order of importance for possible research.

RESEARCH ENVIRONMENT

ACQUISITION AND CONTRACTING PROCESS

The Air Force contracting and acquisition process and environment are considerably different from typical business approaches; therefore, this section is provided. This section briefly describes the acquisition and contracting process to provide the potential researcher a better understanding of the total research environment.

ACQUISITION PROCESS

The acquisition of major systems by the Department of Defense (DOD) constitutes one of the most crucial and expensive activities performed to meet national needs. Its impact is critical to technology, to the nation's economic and fiscal policies, and to the accomplishments of the DOD mission. The system acquisition process developed within the Government is a sequence of specified phases of program activity and decision events directed to the achievement of established program objectives. The acquisition process or life cycle has been described as consisting of five phases: conceptual, validation, full-scale development, production, and deployment. Throughout the acquisition process are major decision events called milestones.

Conceptual Phase: In the conceptual phase, the operational needs and technical inputs interact to determine a needed capability. The primary objective of this phase is to derive military, technical, and economic support as a basis to acquire a new system. Alternative plans are studied to determine the "best" system to meet the operational need. Detailed analysis and planning are accomplished to support a preferred approach which will be used later in the validation phase. Contracts are awarded to conduct technical feasibility studies.

Validation Phase: During the validation phase, the preliminary designs for the new system are tested and verified. The prime objective of this phase is to determine whether or not to proceed with the full-scale development phase. Several contracts may be awarded to perform validation phase efforts through the construction of prototypes. At the end of this phase, a decision is made either to proceed to the next phase or to re-evaluate the weapon system if further technical information is necessary. The optimal system is selected and then submitted for approval.

Full-Scale Development Phase: During this phase, the system is refined through the use of further technical studies and evaluations. The design of the system is solidified. Planning for production, logistical, and training support is accomplished. Engineering models and prototype equipment are fabricated and tested to determine expected operational effectiveness. Also, life cycle and design-to-cost requirements are evaluated to determine effectiveness in achieving cost objectives.

Production Phase: In the production phase, the system is manufactured for operational use. This phase includes the production of spares, support equipment, facilities, and training equipment. Also, any training or logistical plans delayed from the full-scale development phase are completed.

Deployment Phase: This phase begins when a unit receives the first operational systems; however, this does not mark the end of the production phase. The production phase continues concurrently with the deployment phase until all systems under a contract are produced.

CONTRACT PROCESS

Government contracting is guided by the desire to maximize completion, obtain reasonable prices, and assure accountability of public officials. These objectives must be managed along with problems of huge complex weapon systems, inflations, and far-reaching economic effects of Government purchase. The contracting process includes all the actions necessary to obtain goods and services required by the Air Force. The key steps or cycle of the process include: requirements, purchase request, solicitation/evaluation, contract award, and contract administration.

Interwoven in the acquisition process is the contracting process, which impacts during all phases. In the early acquisition phases, the contracts are directed toward research and development contracts. In later phases, contracts may emphasize the delivery and supply of the major end items, spare parts, or major system modifications.

This section has provided a simple description of the framework in which the research topics were formulated. Our basic objective is to improve the various aspects of these processes.

REQUIREMENTS MANAGEMENT

SUPPORT REQUIREMENTS RESEARCH AREA

Objective: To improve wholesale/retail level support decision processes that allocate resources to Air Force operating and support functions. The primary areas of concern are requirements generation and inventory management and control. Requirements generation includes, but is not limited to, provisioning, spares computation, depot maintenance repair computation, and equipment requirements determination. Inventory management and control deal with depot/base interface and stock control and distribution policies.

Background: The USAF logistics support system involves the USAF, the Air Force Reserve, Air National Guard, other US Government agencies, and air forces of nations receiving U.S. security assistance. The Air Force Logistics Command (AFLC) manages approximately \$13.8 billion of inventory with over 800,000 line items. The diversity of applications, operational concepts for deployments, and the number of items involved greatly complicates the managerial resource allocation decision in the total logistics spectrum (e.g., plans and programs, requirements, distribution maintenance, and redistribution and marketing) impact the acquisition process. Before contracting action begins, basic questions of need, quantity, lead time, and cost must be considered. In our complex environment, the various questions are usually expressed in terms of models, many of which are automated. The automated models depend upon various types of computational techniques to reach approximately optimal decisions within specific constraints. The goal of this area is to improve support decisions and the models used in the various processes.

Topic: Inventory Management Policy

Research Need: Air Force Logistics Command (AFLC) investments in Economic Order Quantity (EOQ) type items exceed two billion dollars, and over 500 million dollars are expended annually for replenishment of these stocks. Even small improvements in

the effectiveness of management efforts in this area would provide major savings to the Air Force. In a recent study, it was found that many of the commonly accepted assumptions employed in inventory management texts do not accurately describe the characteristics of AFLC EOQ type items. The following appears to be a more reasonable description of these items:

- a. Demand in any given period is a highly skewed distribution with a significant probability of being in the right-hand tail.
- b. Leadtime variability is significant and is related both to national economic conditions and to item characteristics.
- c. Customers may be divided into several priority classes, and support levels are used to assure high levels of service to the highest priority customers.
- d. Although the general shape of the demand distribution may be assumed known, the parameters of this distribution must be based on statistical estimates. Inventory control levels must also be based upon these estimates. Since demand is highly variable, moving average estimates may change dramatically in periods as short as one year (even two-year moving averages). Control levels based on standard formulas will also change quite rapidly.
- e. Demands for these items are ultimately related to program activity levels for major weapon systems. If a weapon is just entering the inventory, demands for related EOQ items may be expected to increase; if the weapon is being phased out, demand for the related EOQ items will die out. However, accurate models describing this relationship are not yet available.

This list displays some of the basic issues in EOQ inventory policy in the AFLC.

Objective: Research is needed to develop inventory management control formulas and procedures which explicitly recognize the above features, and to determine the sensitivity of Air Force supply effectiveness measures to each of these factors.

Topic: Air Force Acquisition and Support of Communications-Electronic-Meteorological (CEM) Systems

Research Need: Under normal contracting and support procedures for new CEM systems, the Air Force requires acquisition of military specification, configuration management control data, spares provisioning, etc. These procedures require a considerable length of time to determine and a large expenditure of resources to develop. It has been suggested that as an alternative to the current system the Air Force centrally acquire the CEM facility/system and buy one-year spares, commercial data, necessary commercial training, etc. After the system is operational, command support through local purchase should be followed. Spares modules requiring repair could be contracted and minor replacement items, such as fuses, lamps, etc., would be ordered through normal procedures. The anticipated result of this support system is to reduce initial acquisition costs by elimination of certain types of data (MILSPEC) and shifting the CEM support to MAJCOM.

Objective: To provide a comprehensive review and evaluation of the present procedures for contracting and supporting CEM facilities and systems and compare with the proposed system. The study should encompass cost (acquisition, logistics support) and support (training, maintenance, spares, etc.) considerations in the evaluation.

Topic: Demand Forecasting for New Economic Order Quantity (EOQ) Inventory Items

Research Need: The Air Force Logistics Command uses a forecasting inventory system titled D062 to project requirements for non-repairable EOQ spares. A significant portion of existing D062 system backorders is associated with "new" items, items associated with weapons just entering the Air Force supply system. At present, manual methods are used to forecast demand rates for these items. These rates provide the basis for budget requests and associated estimates of support effectiveness.

Objective: Perform research to identify the causes for the relatively high frequency of backorders for new items. This research should include efforts to identify the accuracy of current forecasting methods for these items, and to identify improved methods for forecasting budgetary requirements and associated performance measures.

Topic: Contracting Priorities

Research Need: The contract/requirements computation priority system appears to be a fertile field for improvement. Under the current procedures, a high percentage of procurements are issued to the Air Force Logistics Command (AFLC) Air Logistics Centers buying divisions as priority buys. The high percentage of priority Purchase Requests, over 50% in some buying areas, nullifies the benefits of a priority system. The distinction between routine and urgent can be lost in such circumstances. It would appear that the requirements computation procedure must have a built-in delinquency factor due to the nature of the operation if such a large number of Purchase Requests continue to generate as urgent. It is becoming increasingly difficult to process urgent requirements in an urgent manner because of the volume. An additional aspect to this problem is the impact of international logistics requirements upon contract priorities. All of these factors increase the cost of the procurement system.

Objective: Comprehensively review the contract priority system in order to determine its usefulness and effectiveness. This would include recommendations for change if appropriate.

Topic: Inventory Classification for Aircraft Engines

Research Need: The problems of increased lead times, reduced sources of supply, and the effect of inflation have led to a degradation of the support positions of many critical assets.

For example, increasing lead times on engine spares have disrupted depot maintenance schedules. If inventory assets could be coded by materials contained or production processes, the necessary lead times could be updated for like items based upon current market experience. By Air Force Logistics Command (AFLC) being able to identify these assets, we could establish inventory levels based upon specific product factors. By doing this, there would be a greater potential for savings and/or improved support positions. For example, just having the capacity to identify and buy greater quantities of those items with relatively high first unit costs could in itself be significant.

Objective: Develop a taxonomy for aircraft engines to examine the feasibility of establishing codes to identify supply factors (price, lead time, source) and product factors (production techniques, materials), as well as demand factors of selected items.

Topic: Determine Requisition Size for EOQ Items

Research Need: An Economic Order Quantity (EOQ) simulation model is being developed to represent the Air Force EOQ wholesale supply operations. This model will be used to make decisions on stockage policies and evaluate procurement dollars and support implications. The model computes using a sample of items and their actual quarterly demand history over a five-year period. Given that we know the number of units demanded in a quarter, the model must simulate when requisitions generate within the quarter and the size of the requisition (quantity of units demanded). The current method for determining requisition size is based on the relationship between the number of units demanded and the number of requisitions generating these unit demands for a quarter. However, this relationship was developed when very limited data on the number of requisitions existed. Sufficient data now exists to test the validity of this initial requisition size relationship and its sensitivity to other item parameters (e.g., unit cost, demand variability, etc.) so we can determine the best combination of variables to use to predict the requisition size in the EOQ.

Objective: Determine the best model for estimating the unit size of a requisition for generating demands within a requisition for EOQ items.

Topic: Inventory Model Simulation Requirements

Research Need: The Air Force Logistics Command (AFLC) has developed two major data banks which contain demand history and other management data for both Economic Order Quantity (EOQ) and recoverable items. Data from FY-1971 to the present is available for over 50,000 items. This history data has proven very useful in several simulation studies of proposed inventory management techniques. However, the availability of this mass of data has resulted in several major questions. In particular, what is the best way to select random samples and to design simulation experiments that utilize this data? How much confidence can be placed in statistical estimates obtained from these simulation studies? Since this past data may have been significantly affected by world events that are not likely to recur in the future, how can one adjust for such possible biases? This study should be approached from two perspectives: (1) current data base and (2) ideal data base.

Objective: Develop guidelines for the use of extensive historical data files experiments of proposed inventory management policies. Sampling procedures and experimental design methods which are most appropriate for use in this area should be identified and illustrated by specific examples. Methods for establishing initial conditions and for measuring transient effects should also be considered.

Topic: AFLC System Manager (SM) Management Information System

Research Need: The Air Force Logistics Command (AFLC) SM is responsible for all facets of weapons system support. In recent years, his job has become extremely difficult as the technical complexity of new systems and their associated test equipment has increased. He is responsible for

monitoring/managing a much larger variety of more complex items in accomplishing his goals. The problem arises in that AFLC automated management information systems have not kept pace with these developments. Almost all AFLC data systems are tailored to the needs of the item manager. The SM is required to extract his management information needs from this data. The scope of his present day responsibilities makes this a difficult burden. He appears to require his own automated management information system to produce in a logical, understandable format all the various management indicators he must monitor. The data required is contained in other data systems products and could be obtained by arrangements of proper interfaces. Data the SM needs to see should include, though not necessarily be limited solely to: aircraft not mission capable (NMC) rates, NMC cause codes and terminations, modification status (including funding), depot overhaul status, component item depot overhaul status, weapon system status by base, summary base support status data, and flying hours.

Objective: A management information system oriented toward the needs of the SM could significantly improve his effectiveness in supporting various systems.

Topic: Requirements Projectives for Automatic Test Equipment (ATE)

Research Need: The Air Force must ask a basic question in the development of automatic test equipment: How many items to provide each aircraft squadron? The quantity to buy is dependent on the number of aircraft to support, number and types of line replaceable units (LRUs) to support, mean-time-to-repair (MTTR) of each LRU, mean-time-between-failure (MTBF) of each LRU, test station MTBF, and test station spares quantities available. These factors contribute to test station availability, i.e.,:

$$A = \frac{MTBF}{MTBF + MTTR}$$

However, this inherent availability is much higher than the achieved or operational availability. This is due to delays in availability of spares, manpower, tools, etc. A cost/benefit analysis model is

required to determine where, in the limited funding environment, is the test expenditure of spares mix for LRUs or ATE.

Objective: Determine the most effective expenditure of funds for LRU or ATE spares based upon operational requirements.

Topic: Inventory Adjustment of Government Owned Property in Possession of Government Contractors

Research Need: Government property administrators have no defined criteria on what is not acceptable or tolerated (industry practice or contractor's own policy) inventory shortage. Under certain circumstances a Government contractor may be contractually responsible for such inventory shortages, and Government property administrators need a more definable guideline under Defense Acquisition Regulation (DAR) Supplement 3 before relieving the contractor from responsibility where an inventory shortage is inexplicable. At present, contract clauses and DAR policy do not realistically assist Government property administrators in the performance of their duties in the area of when and how to place responsibility when inexplicable inventory shortages of Government property exist.

Objective: Review and assess contracts' clauses and DAR policy and recommend improvements to assist Government property administrators to determine responsibility for inventory adjustments.

**SYSTEMS REQUIREMENTS
RESEARCH AREA**

Objective: To establish a strategy for managing system acquisition requirements that will assure the achievement of acquisition objectives.

Background: The system acquisition requirements process has long been the topic of high level study and top management, including congressional, attention. It is no exaggeration to state that requirements management is

one of the most difficult problems facing acquisition managers today. The difficulty is increased by the fact that the term "requirements" is not clearly defined in a system acquisition context. Consequently, emphasis has centered on two dimensions: (a) the sequence of activities in the acquisition process and (b) the institutional arrangements, especially review and decision levels such as Defense Systems Acquisition Review Council (DSARC).

Recent efforts have resulted in improved understanding of the sequentially-oriented process. Top management's attention has been concentrated on refinements of organizational element roles in reviewing and evaluating acquisition requirements. The general flow of requirements has been judiciously charted. Directions and branches of flow have been established. Management controls and reviews have been defined and designed into the process like valves, gauges, and spigots in a pipeline. In total, these efforts have done much to clarify and establish control of the process.

However, the requirements process and related management controls need a better means of addressing the varied contents of the requirements pipeline if they are to realize their intended potential.

System acquisition requirements can be divided into the following categories: (a) mission requirements, (b) operating characteristics, (c) design standards and specifications, (d) management system standards and specifications, (e) legal obligations, and (f) programming requirements. This categorization of requirements adds a third dimension to the requirements process flow--substance.

Defining and satisfying each requirement category clearly consume both resources and time, and these costs should be estimated and compared with the benefits derived from each category of requirement.

Topic: Design to Affordability

Research Need: The nation cannot fund (i.e., afford) development and production of all programs considered necessary by the services. Financial affordability decisions are made in terms of both demands upon the present budget and demands upon future budgets. Present decisions to pursue a particular research and development program have with them the accompanying decision to make follow-on decisions for production, operation, training, and logistics support budgets; but life cycle costing approaches tend to concentrate only on costs while accepting performance requirements as given.

The concept of design to affordability broadens the decision process such that an examination of both costs and benefits can be made. Financial affordability decision-making must consider what the nation can or cannot afford in terms of crew safety, environmental impacts, and perceived influences upon future readiness and mission capability. Defense program affordability decisions need to be made at two distinct levels and for two distinct reasons. They should be made within a system acquisition program to aid in making internal program alternative trade-off decisions. They should also be made when choosing among programs competing for national resources. The use of affordability to choose between programs must make clear to national decision-makers what opportunities are foregone if endorsement decisions are not made. That is, we must decide what we can afford to not endorse. It is within the context of limited budgets, lack of adequate past program acquisition practices, need for total program assessment, and trade-off between programs that the improved understanding and application of design to affordability is needed.

Objective: The objective of research in this area is to develop an effective framework for design to affordability decision-making on major system acquisitions. This framework should harmonize the methods and techniques to be used by the Department of Defense, military departments, and defense contractors. It should clearly delineate the application of the system acquisition process structure and contract structures, as well as identify which parts of design to affordability should be implemented: (a) by internal Department of Defense and military department management,

(b) by public policy documents such as the Defense Acquisition Regulatory system, and (c) in the contract process by contractual requirements.

Research Sub-Topics of Interest Include:

1. **Harmonized acquisition affordability decision process.** Acquisition affordability decisions are made in a management system composed of policy structure, decision criteria, organization structure, analysis techniques, contract requirements, and program documentation. The components of the acquisition affordability decision process must be identified with each component of the management system so they are harmonized to support front-end decision-making and provide for program follow-through.

2. **Differentiation and integration of affordability analysis tools.** Life cycle costing, design-to-cost, reliability improvement warranties, failure mode effect analysis, system safety analysis, repair level analysis, and integrated logistics support analysis are a few of the techniques and tools that provide information to assist measuring certain aspects of affordability. There is a need to evaluate the application of this variety of tools to the measurement of affordability, the degree to which they should be integrated (combined), and the need for the development of additional ones.

3. **Measures to affordability.** There is a need to describe both quantitative and qualitative measures of costs (inputs) and measures of benefits (outputs) for system acquisition affordability decision-making.

Topic: Optimal Review Process

Research Need: System acquisition involves a bewildering set of reviews, imposed by different purposes. These include the Defense Systems Acquisition Review Council (DSARC) O, I, II, III; a series of business/acquisition and contract reviews; design reviews (preliminary, critical, and physical configuration audit); and production readiness reviews. Each review requires significant preparation and time commitment and draws attention and

effort away from direct accomplishment of system development and production.

Objective: Define the authority, objectives, timing, and scope of each major type of review imposed on a system acquisition program. Evaluate the impact on program progress, the benefit derived from the review, and the impact if the review was deleted, rescheduled, or combined with another review. Make recommendations regarding the overall review process.

Topic: Modification Program Requirements

Research Need: Substantial acquisition funds are spent in modifying existing systems rather than procuring new ones, but little research has been carried out on the special acquisition problems of modification programs.

Objectives:

a. Clarify the key steps in the decision to modify a system rather than replace it.

b. Where modification is the choice, clarify the decision process that determines the order (in time, serial number, etc.) in which modification will be made.

c. Model the factors and alternatives that must be considered in implementing modifications into an existing system.

d. Recommend any changes in the modification process that would provide the Air Force lower costs, better schedules, or greater effectiveness.

Topic: The Effect of Cost Benefit Analysis on Standardization vs Technological Advancement

Research Need: There is a need to achieve a delicate balance between standardization/commonality and technological advancement. It is possible that requiring extensive formal cost benefit analysis in the conceptual/design phases of a program would lead to increased equipment standardization/commonality. However,

another possible result is that innovation will be suppressed. The study needs to determine if increased utilization of formal cost benefit analyses would lead to more standardization/commonality. Have previously performed analyses led to the selection of standardized or common equipment, or have they been used to justify new technology? When formal analysis is extensively applied, is technological innovation suppressed to the extent that long term Air Force objectives are compromised? The result of the study should be a recommendation regarding the use of formal cost benefit analyses.

Objective: To use cost benefit analysis in achieving optimum long run trade-offs between standardization and technological advancement.

Topic: The Acquisition Program Manager and Standardization

Research Need: The impact of the acquisition program manager on standardization objective is unclear. Since no formal documentation of decisions relating to standardization is maintained, the amount of influence of the program manager and the direction of that influence cannot be determined. Does the project manager control, get involved with, or maintain knowledge of standardization decisions? Standardization always carries some element of risk to the project, risk that the standardized item will not be delivered on time or live up to its expected performance, risk that the contractor will have difficulty in interfacing, etc. Do program managers eliminate this risk by implicitly making a decision to not use standard equipment by not addressing standardization at all? How can program managers be given enough incentive to make the standardization decision visible, and to push for standardization? (Note: An AFBRMC sponsored study indicated that program managers are "graded" or evaluated based on their success in bringing their programs to completion with cost, schedule, and performance parameters.) The program manager has an incentive to award or reduce the impact of decisions which may involve elements of risk in meeting these parameters.

Objective: To study and document the interface between program managers and standardization objectives and to determine ways to make it a "win-win" situation.

Topic: Standardization/Commonality vs Competition

Research Need: Standardization/commonality leads to fewer equipments and multiple usage of existing designs. This reduces the degree of competition, particularly if the design was sponsored by contractor funding. The more standardization, the greater the reliance on "sole-source" contracting. How can the conflict between standardization and competitive contracting practices be resolved? Are there commercial examples of the same type? What lessons can be learned from commercial examples? Can these lessons be applied to Air Force situations?

Objective: To determine ways to increase compatibility between standardization/commonality objectives and Air Force contract objectives.

Topic: Standardization Focus in Weapon System Acquisition

Research Need: Much of the discussion about standardization evolves around avionics subsystems/equipments. What other equipment areas provide potential for savings via standardization/commonality practices? What measures can be used to gauge the potential standardization savings (acquisition costs, life cycle costs, etc.)?

Objective: To determine areas of acquisition where standardization can yield major benefits to the Air Force.

BUSINESS RELATIONSHIPS

CONTRACTOR MOTIVATION RESEARCH AREA

Objective: To improve our understanding of the motives which influence the actions of business institutions competing for and performing contracts involving unique products and services.

Background: A large segment of economic activity involves procuring unique products or services frequently involving long time spans and requiring significant technological or managerial innovation. The specialized nature of these one buyer-one seller situations has led to a growing realization that market theory economics is in some important respects an unsatisfactory guide for policy and actions. Although numerous approaches have been proposed to secure the advantages of competitive market behavior to the one buyer-one seller environment, many serious policy issues require more accurate understanding of contractor motivational patterns. This topic may be approached through a number of avenues such as contract incentives, capital investment policies, nonfinancial barriers to entry (e.g., red tape), and transaction costs. Related research areas include Life Cycle Performance Evaluation and Socio-Economic Considerations.

Topic: Calculation of Profit on Negotiated Contracts

Research Need: On negotiated contracts profits are largely calculated on the basis of production costs. Only ten percent of the profits total is based on contractor investment as specified in Defense Acquisition Circular 76-3 effective 1 September 1976. Cost Accounting Standard (CAS) 414 also excludes working capital from the base. Profits are, in part, a return on capital. If the necessary return on capital is to equal its opportunity cost, profits should be calculated on the base of capital rather than costs. This should remove the incentive for contractors to raise costs and encourage them to make

private defense investments. These assertions need further study and verification.

Objective: To evaluate the impact of computing profit on negotiated contracts based on total capital invested by the contractor to accomplish a project.

Topic: Flow Down on Firm Fixed Price (FFP) Subcontracts in Conjunction with Flexibly Priced Prime Contracts

Research Need: Many major weapon systems acquisitions are being placed as incentive-type contracts with prime contractors. Many of the prime contractors are subcontracting significant portions of the prime contracts using firm fixed price subcontract arrangements. The value of these firm fixed price subcontracts could encompass 30 to 40% of the prime contracts' target costs. It is very difficult to rationalize a fixed price incentive (FPI) ceiling price being established as a percentage of target costs when it is known that a significant portion of those costs are attributable to FFP subcontract efforts. It would appear that a study should be initiated to determine the proper flow down contract arrangements with prime contractors. It is our opinion that we should not discourage the prime contractors from seeking FFP arrangements with the subcontractors. However, it may be feasible to structure the prime contract with a portion (primarily subcontractor effort) being placed as an FFP contract while the remaining portion of the technical effort (that being accomplished in the prime contractor's facility) being issued under the flexibility priced arrangement. This would assure that the cost incentive of the prime contract would apply only to that portion of the weapons systems appropriately regarded as effort susceptible to incentive provisions.

Objective: To determine the feasibility of structuring contract flow down arrangements in the above type contracts.

Topic: Cash Flow as a Contractor Motivator

Research Need: The impact of progress payments on a contractor's cash flow situation can be substantial and should be considered as a method for improving contractor performance. The ability to assess the response a contractor would have to changes in the level of progress payments is an important and much needed management capability.

Objective: To develop and validate a method for assessing the contractor's response to changes in cash flow payments during the major phases of systems acquisition.

Topic: The Competitive Market Environment of the "Defense Industry"

Research Need: There is need for an analysis of the competitive environment that the Government deals in. If it can be determined that the Government is dealing with several distinct marketplaces (i.e., pure competition, monopoly, monopsony,) then a different strategy can be designed for each market. Rather than just using profit as the primary motive for all contractors, perhaps other motives can be utilized that will be more effective and less costly than the present system. Finally, there is a need to determine the correlation between the Government's need, whether it be a major system acquisition, a service, or a supply need and the type of competition. If there is a strong correlation, then separate contract strategies could be developed for each type of Government need.

Objective: To identify the competitive market environment of the defense industry. The research effort should determine whether the Government is simultaneously dealing in several types of competitive environments. Further, it should be determined whether there is a correlation between the type of competitive market environment and the type of Government need (i.e., system acquisition, service, support, or supply).

Topic: Effective Utilization of Competition in Weapon System Development

Research Need: Acquisition and contracting policies relative to competitive versus sole source are sometimes not in the best interest of the Government in meeting acquisition objectives. For example, systems developed under a competitive prototype strategy often must comply with competitive contracting policies when low level production of items identical to the prototype are being sought. This practice is often restrictive and illogical. In many cases this situation would justify a single contract for a prototype with production option once units have passed qualification tests. This is prevented under present policy unless the production option can be exercised within three years. The use of competition at all stages of the acquisition process must be assessed. Focus should be on contractors attempting to meet the Air Force's need for new weapon systems identified as part of the Department of Defense's Defense Systems Acquisition Review Council (DSARC) decision process (e.g., those required to meet milestones O, I, and II).

Objective: To assess acquisition and contracting policies that require competitive contracting on follow-on production contracts and to develop improved techniques for insuring reasonable price for production units in a single source environment.

**CONTRACTING
(TECHNIQUES AND MANAGEMENT)
RESEARCH AREA**

Objective: To evaluate existing contracting techniques and procedures for their effectiveness in achieving the overall contract objectives and develop new and innovative techniques for improving the contracting process.

Background: Contracting includes those actions necessary to obtain goods and services required by the military. The contracting process can be divided into the major segments of requirements cycle, purchase request cycle, solicitation/evaluation cycle, award cycle, and contract administration cycle. This research area comprises projects designed to evaluate

and improve contracting techniques and management in these five cycles to make it more efficient and effective.

Topic: Source Selection Process Decision Making

Research Need: The source selection process is used extensively on major Air Force acquisitions. It is not always applied consistently and thus does not provide a means to establish a disciplined approach to decision making during the process.

Objective: To identify weaknesses in the present process resulting from inconsistencies in interpretation and application. Once these problem areas have been identified and described, available problem solving/decision analysis techniques will be selected that should provide for a more systematic disciplined approach to source selection. This will provide for more effective decision making in source selection and permit management to provide for improved training in the use of the source selection process. A review of the process used by the Kepner-Tregoe Company would be a good starting point for this study. This study will provide a comprehensive source selection guide and examples of source selection applications for training. It should provide an outline for the orderly development of an official training manual for the process.

Topic: Comparative Analysis: Government and Commercial Solicitation Documents

Research Needs: Solicitation documents must be adaptable to a variety of different contract types and situations. A significant number of Government acquisitions involve construction and off-the-shelf items. Further, one might assume that profit-motivated commercial enterprises, in the interest of efficiency, would have developed solicitation methods that strike a balance between simplicity, adequacy, and reduce costs.

Objective: Research in this area would:

- a. Identify previous existing studies on the subject.
- b. Compare DOD and private industry solicitation by similar commodities, dollar thresholds, and contract type.
- c. Identify areas for increased efficiency through use of commercial techniques.
- d. Identify statutory and regulatory impediments to implementing commercial practices and recommend possible courses of action to resolve the impediments.

Topic: Lead Time Involved in Contract Award

Research Need: Many large dollar value (i.e., \$1 million plus) competitive acquisitions take in excess of eighteen months from receipt of program approval to contract award. These delays are causing impacts on user requirements and tying up personnel thereby decreasing mission effectiveness and productivity.

Objective:

- a. Compare DOD versus industry lead times on similar commodities.
- b. Identify and measure the impacts of prolonged acquisition processes on user requirements and program management and contracting function productivity.
- c. Provide recommendations on how to streamline the competitive acquisition process based on the findings of a. b., and provide a comparative analysis of industry procedures.

Topic: Quantifying the Impact of Personnel on Contracting Administrative Lead Times (PALT)

Research Need: Currently there is no adequate uniform method or set of indicators for assessing the impact of gains and losses in personnel on

overall and specific contracting administrative lead times experienced in base, research and development, and systems acquisition/contracting activities, respectively. Each of these activities are unique as to numbers, types, dollar values, and complexity of contract actions processed. In addition, different processing systems are employed in each type of contracting activity. Hence, each type of activity may have to be studied separately, perhaps utilizing different methodologies and criteria in each case. Average or parametric and not linear relationships between personnel and PALT should be assumed because of the labor intensive nature of the contracting process.

Objective: Using an operation's research type approach, design separate PALT-human resource models and develop separate PALT-human resource organizational management indicators that can be generalized to base, research and development, systems, and logistics contracting activities, respectively.

Topic: Rapid System Acquisition Model/Manual

Research Need: There is no organized and prioritized statement of tasks to guide a program manager and contracting officer who are directed to acquire a weapon system for operational use on an urgent or expedited basis. Availability of research based guidance would improve contracting productivity and reduce acquisition time.

Objective: Develop a model or manual for use by System Program Office (SPO) and contracting personnel on how to accomplish the rapid acquisition of a weapon system. The end product is to be based on "lessons learned" from other programs.

Topic: Insurance Expertise in the Air Force

Research Need: In the initial phase of contracting the conflicting desires of the Government and

contractor often arise over the extent and nature of insurance. The Government is at a disadvantage since the contracting officer, unlike the contractor, does not have access to insurance agents versed in the nuances of coverage and familiar with the price of insurance. Thus, the Government may obtain less than optimal coverage, and may pay an excessive price for that coverage. This lack of Government expertise further manifests itself when an event occurs which the Government believes should be covered under the insurance. The Government is at a severe disadvantage in meeting the arguments of the contractor because of this lack of insurance expertise.

Objective: Define the extent of the problem and identify the appropriate method of supplying this expertise. Sample the experience of representative contracting and pricing activities to establish the specific areas of policy and pricing which must be addressed.

Topic: Airframe Manufacturers Insurance Programs Covering the Loss of Government Property in their Possession

Research Need: Under Inspect and Repair as Necessary (IRAN) modification contracts there are occasions when airframe manufacturers misplace, lose, or damage salvageable parts while working on Government aircraft. Hence, new aircraft parts are installed at increased cost to the Government.

There are no guidelines to assist Government property administrators and administrative contracting officers in assessing airframe manufacturer's responsibility where it is demonstrated that the loss/damage of Government property results from a prima facie inadequacy of contractor's property control system.

The Air Force is presently having a difficult time holding Government contractors responsible for these type of losses within the meaning of alternate paragraph (g) of the Government property clause, Defense Acquisition Regulation (DAR) 7104.24(c). In order to be successful in court or before the Armed Services Board of Contract Appeals (ASBCA), the Government must demonstrate, under the clause, that airframe manufacturers do not customarily carry insurance or a reserve of self-insurance in accordance

with the contractor's normal practice or the prevailing practice of the industry to cover lost/damaged parts when such losses/damages result from inept contractor's managerial inventory practices.

Objective: Determine the extent of coverage of alleged "all risk" insurance policies which includes a hangarkeeper's legal liability clause. Determine Government's responsibility to assure adequacy of contractor's property control system before and after receipt of Government property.

Topic: Automatic Data Processing Equipment (ADPE) Acquisition Requirement Process

Research Need: The passage of the "Brooks Act" (PL89-306) (40 USC 759) made General Services Administration (GSA) the Government's single source authority for approval of acquisitions of Automated Data Processing Equipment (ADPE) and software. GSA has done an adequate job of handling the problem in the past. Presently, as more and more systems and functions are automated, GSA has been unable to hire and/or retain enough personnel with computer backgrounds to keep up with requests.

Also, there is much confusion about approving automation and a Delegation of Procurement Authority (DPA) from GSA. Most Air Force agencies are unclear as to the relationship of approvals to automate a function and approvals to acquire the hardware/software necessary to automate that function. Air Force 300 series regulations provide extensive approvals for automation of a particular system or function. These approvals do not amount to approvals to purchase, only approvals to automate. However, the personnel involved in the approval process have backgrounds in ADPE technology. By maintaining that capability and adding contracting capability, the approval process could accomplish two things: (a) approve the automation of the function and (b) approve the acquisition of the hardware/software. The present approach to acquiring ADPE appears too cumbersome and ineffective in an environment of rapidly changing technology.

Objective: Develop a streamlined approach for the acquisition of ADPE equipment to enable the Air Force to obtain the latest technological equipment. This should include an effective procedure for approval authority.

Topic: Review of DOD Contract Language

Research Need: As an offshoot of the contemporary "consumer movement," many firms are rewriting such legal documents as credit agreements and insurance policies in "plain English" formats. For identical reasons (i.e., increased communication and understanding) Government contract clauses may be subject to simplification and hence clarification.

Objective: To determine the feasibility and methodology of a contract terminology rewrite program. The objective of the second phase of this research project would be to develop, test, and validate prototype contracts written in plain English.

Topic: Draft Request for Proposals

Research Need: Air Force Systems Command and other departments have been utilizing the Draft Request for Proposal (DRFP) concept for the past several years. A thorough assessment of the effectiveness of this concept is needed. The research should include both Government and industry application of the concept in order to provide a broad view of methodology and results.

Objective: Further refine the DRFP procedure. The focus of the research will be directed to improving Government administration of the technique and contractor understanding of the information contained in an RFP.

Topic: Contracts Containing More than One Method of Payment

Research Need: Although it is not specified in the Defense Acquisition

Regulation (DAR) and other Government regulations, many contracts allow more than one reimbursement within a single contract. For example, within individual contracts some line items are incorporated on a cost reimbursement basis while others are specified to be paid on a firm fixed price basis. Such arrangements could provide a workable alternative to single pricing arrangements (i.e., all fixed price, all cost plus incentive fee, etc.).

Objective: Perform a rigorous analysis of contracts having multi-contract type line items to:

- a. Identify instances where these arrangements have created serious confusion in financial administration, tracking, and payment.
- b. Assess the feasibility, advantages, and disadvantages of such arrangements.
- c. Identify problems in such areas as negotiation, contractor-Government responsibilities, contract administration, financial administration, tracking, and payment caused by such arrangements.
- d. Recommend policy guidance and revisions to DAR to preclude improper charges against line items, and improve Defense Contract Audit Agency/Defense Contract Administration Service Region (DCAA/DCASR) audit surveillance procedures.

Topic: Standardization of Source Selection Evaluation Procedure

Research Need: Descriptions of the source selection process in solicitations vary widely throughout Air Force Systems Command. This prevents consistent, efficient application of the source selection process. It hinders understanding of the process by contractors and creates unnecessary problems for both Air Force and contractor managers. Definitions and emphasis vary. Research is needed to review solicitation documents and standardize the words and their definitions being used.

Objective: To determine the feasibility of developing and using

standardized source selection procedures. If feasible, develop a consolidated guide which outlines consistent terms to be used for the preparation of source selection solicitation documents. This research will incorporate the need for tailoring the source selection as necessary and provide guidance for deviation from the recommended normal selection method.

Topic: Methods for Increasing the Use of Previously Developed Equipment

Research Need: A recent study concluded that Department of Defense (DOD) buying activities tend to totally support a contractor's program approach at source selection, even if it is counter to Government policy on standardization and use of off-the-shelf equipment. In some cases, the contractor might develop new equipment when off-the-shelf items would do. A need exists to find ways to motivate the contractor to use as much off-the-shelf equipment as possible. The research should investigate the following representative areas:

- a. Reasons why contractors do not standardize or use off-the-shelf equipment.
- b. Contractual and non-contractual incentives to achieve the DOD's standardization/off-the-shelf equipment goals.
- c. Evaluation of the effectiveness of existing incentives to achieve DOD's goals.
- d. New and innovative approaches to the problems.

Objective: To investigate and analyze the feasibility of using contractual and non-contractual means for encouraging a contractor to use previously developed equipment in lieu of developing new designs.

INDUSTRIAL BASE RESEARCH AREA

Objective: To maintain appropriate and efficient industrial capability consistent with current and projected national defense requirements.

Background: The ability of the industrial base to support Department of Defense (DOD) requirements is an important aspect of national defense. An improved understanding of the character and extent of the Defense Department's requirements for the national industrial base is needed. Research in this area can be directed into several basic dimensions: (1) industrial production capability and (2) materiel resource requirements for national defense purposes. The industrial production capability is concerned with research/development, plant/equipment, and manpower (skill and training) capabilities of industry to meet DOD requirements. DOD policies and practices relating to industrial reserve facilities, Government-furnished property, Government-owned/contractor-operated facilities, and industrial preparedness planning are of specific interest. The materiel resource dimension is concerned with identifying and assessing potential shortages of raw materials and energy resources required for the production and operation of military equipment and actions that could help alleviate such problems.

Topic: Critical Resource Management

Research Need: The defense industrial base is as much an element of our military deterrence as our array of weapon systems. The industrial base must provide high-quality weapon systems and support equipment at minimum costs. It must be able to accelerate production on demand both in war and peace. Unfortunately, for some military programs the industrial base is inadequate. In many military projects there are critical items that can be procured from only one or two sources. A good example of this is a space-qualified traveling wave tube amplifier (TWTAs). There is one source that supplies approximately 95% of all the TWTAs flown on Government or commercial satellites. Dependence on single

source can sometimes cause significant program problems that can delay schedule and result in large cost overruns.

Objective: Develop a list of critical items that can be procured from only one or two sources and investigate potential ways to eliminate items from this critical list.

Topic: Contractor Management of Government Property

Research Need: Acquisition and contracting managers often face problems relative to Government property being used by defense contractors. These problems vary in severity but, in most cases, result in substantial costs to the Government in terms of lost or damaged property and management time spent addressing such problems. Losses and damages to Government property are also the subject of frequent, costly investigations and form the basis of severe criticism of the Department of Defense and Air Force by Congress and various sources in the civil sector. Therefore, a study needs to be conducted to identify and develop management approaches and techniques to minimize loss and damage to Government property used by defense contractors. For example, suggested topics for study are use of the award fee for Government property management and treating contractor management of Government property as a direct contract cost element. Each approach identified should be considered for its potential costs and benefits to the Government.

Objective: Identify and develop management approaches for use by acquisition and contracting managers to minimize loss and damage to Government property being used by defense contractors.

Topic: Cost Effective Capital Equipment Modernization Rate

Research Need: The Air Force depends upon industry to provide

effective weapon systems and support equipment. Weapon system acquisition strategies have used a variety of techniques and initiatives to assure that contract costs are minimized. However, one characteristic of acquisition has not been changed. Major weapon system acquisition is priced on a cost basis and conducted in a bilateral monopoly. Costs to produce weapon systems are paid to contractors within legal limits of allowability, allocability, and reasonableness. One hypothesized reason that production costs of weapon systems cannot be lowered is that a high proportion of capital equipment used is outdated and inefficient. A study is needed to determine if the hypothesis can be supported.

Objective: To determine if the industrial plant and equipment used in weapon system production is outdated and inefficient. Also determine what is the optimum modernization expenditure rate for both Government and industry to lower total costs to the Government. Also outline an approach to modernize industrial plant equipment and lower production costs on future production of weapon systems and follow-on support.

Topic: An Analysis of the Effectiveness of Plant Equipment Packages (PEPs)

Research Need: The purpose of PEPs is to identify and retain Government-owned industrial plant equipment (IPE) (i.e., capital equipment) which is essential to the production of mobilization requirements assigned to contractors. The IPE included in PEPs should be the total amount needed to support industrial preparedness planning (IPP) mobilization requirements less that equipment available in private industry to fill such mobilization requirements. Possible research questions to consider are: (1) if all reviews and approaches required to establish PEPs are beneficial to the quality of the end product, (2) if existing procedures and practices contemplate the use of an appropriate portion of contractor capability on production of consumer items concurrent with mobilization requirements, (3) if the methods used to identify and retain special tools and special test equipment for special purposes, such as IPP, could be partially or wholly used

as an alternate to PEPs, (4) if there is a better way than the use of PEPs to assure retention of the industrial base essential to meet mobilization requirements, and (5) if inspections and audits could be effectively used to assure the necessary industrial base is being retained and excess equipment is not retained.

Objective: The objective of the research would be to analyze current methods to determine if plant equipment packages are effective and worth the cost. Therefore, the above referenced research questions need to be addressed.

**COST ESTIMATION AND
ANALYTIC METHODOLOGIES
RESEARCH AREA**

Objective: To improve the validity and reliability of weapon systems cost estimates and to provide acquisition managers with improved knowledge about the purpose and nature of cost estimates and how they are generated.

Background: Cost estimation problems can be categorized into two general areas. First, institutional considerations regarding responsibility for generating cost estimates during each phase of the acquisition process. Various organizations generate estimates for the same system, but these estimates are frequently different resulting in the problem of selecting the proper estimate for decision-making use. Second, application problems exist where estimating methodologies are used incorrectly or improved methods are required. Acquisition managers need to improve their understanding of the overall process of how and why cost estimates are developed and the relationship of each estimate to the acquisition process. Further, new methodologies are needed to address known technical deficiencies that impact cost of weapon systems.

Topic: Technological Uncertainty and Cost Growth During Weapon System Development

Research Need: Weapon systems development programs continue to experience cost growth. A major factor of cost growth during development is the technological uncertainty about particular systems when initial development cost estimates are prepared. Most of the methods used to prepare these costs do not include consideration for technological uncertainty. A recent series of studies indicate that the use of an entropic cost model may be used to forecast growth due to such uncertainty about development program outcomes.

Objective: Evaluate/validate the entropic cost model and its application to forecasting cost growth due to technological uncertainty about weapon system development.

Topic: Determination of Cost (to Contractor) of C/SCSC Validation

Research Need: Since Cost/Schedule Control System Criteria (C/SCSC) were imposed by the Government, defense contractors have used various direct and indirect allocation techniques for costs incurred to support C/SCSC. Existing studies on cost effectiveness of C/SCSC should be researched and compared to current cost of C/SCSC application to reevaluate C/SCSC cost effectiveness. Contractors doing business with Air Force Systems Command should be queried as to the marginal cost of C/SCSC. The research results should point out weak areas of application that need attention and identify strengths that can be used in other programs.

Objective: Reevaluate cost effectiveness of C/SCSC by researching completed studies and comparing the results with current marginal cost of applying C/SCSC.

Topic: Study of Software Development Cost/Program Size

Research Need: Software development costs are becoming a larger part of total weapon system development costs. Current methods for estimating

software development costs rely on estimates of software size (i.e., number of object or source instructions) as input. Therefore, no simple, manageable method or technique exists for accurately estimating software size. Doty Associates have developed (for Rome Air Development Center (RADC)) estimating relationships (ERs) for size. However, these ERs have not been validated for use by estimators. If valid, the ERs developed by Doty Associates should provide cost analysts/estimators with improved tools for forecasting software development costs.

Objective: Validate program size ERs developed by Doty Associates for RADC.

Topic: Impact of Contract Changes on Cost Growth

Research Need: Air Force contracts change in several ways during the performance period. Changes in scope, prices, delivery schedules, product design, and numerous other items ultimately cause cost growth. To manage this cost growth requires detailed information. Studies are needed to address this issue. A data base has been established at the Air Force Business Research Management Center (AFBRMC) for use in these studies.

Objective: Study and analyze cost growth caused by changes in contract scope, prices, delivery schedules, and product design.

Topic: Application of Linear Filters to Cost/Economic Data

Research Need: Discrete linear filtering techniques and methods are applied to many physical feedback and control systems such as radar systems. Quite often these systems are subject to noise and interference caused by external conditions and internal malfunctions that require discrete data to be smoothed or filtered. Cost/economic data are often affected by events that cause fluctuations in data used for analysis and forecasting costs. Most cost estimating methods are based on traditional time series or regression models. These methods are sensitive to fluctuations in data and often provide questionable results.

Objective: Determine utility of discrete linear filtering techniques to analyze cost/economic data.

PROGRAM MANAGEMENT

PRODUCTION/MANUFACTURING MANAGEMENT RESEARCH AREA

Objective: To improve production/manufacturing management policy, procedures, and practices.

Background: Production is the transformation of resources into goods and services. Production/manufacturing management is defined as the "art and science of properly and efficiently using men, money, machines, materials, and processes to economically generate goods and services." In practice, production/manufacturing management is a blend of operations research, industrial engineering, economics, and behavioral science. Successful management during the production phase of the acquisition cycle requires development of sound production and manufacturing objectives before production go-ahead and assurance that these objectives are accomplished during production. Research results are needed to provide management with the tools and knowledge to improve the policy framework and procedures that support decisions to produce and to support weapons systems and meet cost, schedule, and quality requirements.

Topic: Production/Manufacturing Management Approaches and Techniques

Research Need: Since 1971, there have been several Department of Defense (DOD) and Air Force efforts to emphasize the importance of production and manufacturing management as part of the acquisition and contracting environment. The Air Force has implemented concepts such as Manufacturing/Management Production Capability Reviews and Production Readiness Reviews to assess and determine contractors' capability and readiness to meet weapon system production requirements. Also, there have been strong efforts in the Air Force to

revitalize the Manufacturing Technology Program to explore and promote advances in the methods, processes, and materials used to produce weapon systems and subsystems. These initiatives have resulted in significant improvements to the acquisition process; however, it has also been recognized that the use of new management concepts and techniques needs to be tailored to acquisition programs in a variety of settings (e.g., stable follow-on production, transition from prototype to full-scale development, major modifications of existing systems, and acquisition of commercial "off-the-shelf" systems). Further, consideration must be given to the type of product or system being acquired. For example, flight simulators, munitions, and major modification programs all have unique production characteristics. The nature of the product and the manufacturing technologies required to produce it should be major factors in determining the approaches and techniques to be used to manage its production. Further, existing systems such as the cost schedule control system (C/SCSC) and network based systems often fall short of management's qualitative and quantitative needs to effectively plan and manage a program during production.

Objective: The objective of this study effort is to develop a comprehensive guidance document for Air Force production/manufacturing managers to plan, execute, and control production and manufacturing requirements during acquisition of weapon systems and modification of existing systems. This document will fully describe each approach or technique to be used for given sets of acquisition program characteristics and objectives and provide examples to help management understand the strengths of each approach in given situations.

Topic: Valid Criteria for Scheduling Techniques

Research Need: Several scheduling techniques have been recommended to Electronic Systems Division Director, Programs/Budget, for use on highly visible programs (particularly for planning and analysis). However, there are relatively few studies available that address factors, criteria, types of contracts, etc.,

that should be considered in selecting particular scheduling techniques. For example, what is the best technique to use for planning activities leading up to contract award? Also, when should line-of-balance versus critical path or Gantt charts be used? Development of criteria would help acquisition managers determine proper manning levels, proper time phasing of events, and logical program structure.

Objective: Develop criteria and procedures to determine proper scheduling techniques for use in planning and managing system acquisition.

Topic: Efficient Production Rates

Research Need: Acquisition decision-makers and managers whose programs require quantity production of systems, subsystems, or components are continually faced with the question, "Given a certain amount of funds, how many can we buy this year?" The possibility exists that funds will be sufficient to meet program objectives. However, more often than not, fiscal year funding is a major constraint on the number of production units acquired during any given year. At the same time, the possibility also exists for situations to occur that may cause an increase in quantities required. Results of these situations usually impact production schedules in the form of stretch-outs or schedule compacting. Therefore, the rate of production presents key issues to acquisition program decision-makers. Management needs sound planning approaches and monitoring techniques to meet production requirements and assure that contractors use resources efficiently to keep costs in line with budget limitations.

In general, methods and models have been developed that reflect business and economics researchers' efforts to study and describe production demand phenomena. Unfortunately, results of efforts frequently satisfy academic and professional needs and fail to cross the "gap" to empirical application. Research should be conducted to develop and improve existing policy and guidance for decision-makers and managers use when they must consider issues that affect or are affected by production rates. Researchers should explore the possibility of realistic application to

the acquisition environment concepts such as linear and non-linear programming, economic order quantity, quantity discounts, quantity-rate models, and other economic and production models. Further, such concepts should be translated into policy guidance that meets needs of managers and decision-makers faced with problems of selecting alternative courses of action for quantity production.

Objective: Develop guidance that reflects the best techniques available for determining the rate of production that best fits the needs of acquisition managers and decision-makers to accomplish program objectives. Translate techniques into recommended policy and policy change.

Topic: Long and Short Range Costs and Benefits of Make-or-Buy Policy

Research Need: Department of Defense acquisition and contracting policy requires that acquisition of weapon systems includes make-or-buy considerations in contracts for systems and products that meet certain criteria outlined in the Defense Acquisition Regulation (DAR). These criteria are based primarily on dollar thresholds, product complexity, and type of program. There is no guidance that requires the contractor to perform a cost and benefit analysis when arriving at a make-or-buy decision. Therefore, a study needs to be conducted to assess situations where make-or-buy policy has been required and those where it has not been used. Such a study should be directed toward long and short term costs and benefits of using make-or-buy policy.

Objective: Develop criteria and guidelines for program managers to use in determining when to apply make-or-buy evaluations by contractors.

Topic: Government-Furnished Equipment (GFE) Breakout Analysis

Research Need: The Defense Acquisition Regulation requires contracting organizations to identify contract end items that can be obtained direct via Government sources as opposed to acquisition by a prime contractor.

Rationale provided for breakout is that prime contractor overhead, profit, etc., are added to the basic item cost and money can be saved if procured direct via Government channels. However, specific criteria does not exist to identify items to be broken out as Government-Furnished Equipment (GFE). Factors such as manpower limitations, Government personnel costs, Government overhead, Government contract lead times, Government assumption of liability for GFE etc., are all subjective aspects of the decision process.

Objective: Develop quantitative criteria and techniques to assist Government evaluators and decision-makers to better determine cost/benefits of items broken out as GFE and to improve management of GFE.

Topic: Production/Manufacturing Cost Drivers

Research Need: Many key decisions are made during early planning for weapon systems that eventually impact cost during production/manufacturing of a system. Due to a widespread assumption of the American "can do" attitude, planners and decision-makers often fail to explicitly address production/manufacturing cost drivers. This attitude causes processes and productive systems to "optimize" costs with given constraints. It is quite possible these "optimum" costs could be lowered if constraints were restructured by treating requirements explicitly during early planning phases. There is a need to identify and describe key decisions and operating constraints that drive production/manufacturing costs of weapon systems. Also needed are techniques for explicit identification of decision inputs by both Air Force and industry production/manufacturing manager.

Objective: Identify and describe key decisions and operating constraints that drive production/manufacturing costs and identify explicit inputs required by the Air Force and industry that have a direct impact on such costs.

**FOREIGN MILITARY BUSINESS
RESEARCH AREA**

Objective: Identify, define, and examine the issues of foreign military business (FMB) on the U.S. defense acquisition process. Provide ideas and recommendations for management policies and procedures used to cope with Air Force involvement with FMB.

Background: FMB consists of foreign military sales (FMS), international cooperative programs, and grant aid. The major issues spanning these three areas are:

a. Conflict Resolution Process. The thrust of this topic is managerial in nature (i.e., the objective is to manage conflict). The major issue concerns negotiations involving memoranda of understanding, price and availability data, and letters of offer and acceptance.

b. Impact of FMB on Acquisition and Contracting Policy and Procedures. Organization for effective contracting support where international participation is involved is a major issue under this topic. Other issues include the application of various statutes, Defense Acquisition Regulation (DAR) provisions, etc., to FMB situations; acquisition planning when requirements other than those of U.S. forces are included.

c. Management of International Programs. Many major issues fall under this topic: coproduction and codevelopment; interoperability/standardization; offset management (incorporating acquisition from foreign sources); technology transfer and foreign disclosure; and binational, multinational, or consortium management efforts.

d. Logistics Support. Inevitably, each of the three aspects of FMB results in a requirement for logistics support. Thus, a major issue is the cooperative logistics support system maintained by the Air Force Logistics Command (AFLC). Elements of this issue include support alternatives, financial management, and such things as transportation and communication. Also involved is the area of Air Force Systems Command (AFSC)/AFLC interface, product support and the engine Component Improvement Program (CIP).

Topic: Examine and Compare to US the Philosophies, Standards, and Procedures for Auditing and Cost Accounting of Selected European Countries

Research Need: The US is now involved in cooperative weapon systems development and production with NATO allies in European countries, and such agreements can be expected to increase in the future. These agreements require that US audit agencies, notably the Defense Contract Audit Agency (DCAA), cooperate with European audit agencies. In some cases the US Government has agreed that it will use European audits rather than those of US audit agencies.

The experiences to date have shown that significant differences exist between the audit function in the US and those used in European countries. These differences are not only in the area of audit procedures employed, but also philosophical differences in the role of the auditor. Because of these differences, "bottle-necks" in the acquisition process have occurred. As cooperative acquisitions continue, it is essential that systems managers, contract administrators, etc., have a greater knowledge of the audit function in Europe.

Objective:

- a. Analyze audit philosophies, standards, and procedures in selected European countries as they relate to Government contracts.
- b. Compare these with audit philosophies, standards, and procedures within the US Government.
- c. Formulate implications and guidelines for US personnel involved in cooperative acquisition programs.

Topic: Foreign Military Sales (FMS) Customer Unique Logistical Support

Research Need: Under FMS, the sale of major weapon systems typically includes both the end item and follow-on logistical support. Since many weapon systems are configured to meet the requirements of individual countries, added logistics support burdens are placed on the US. For example,

nonstandard replacement parts are being introduced into our inventory but appear to be administered and tracked in the same way standard parts are tracked.

Objective: The following questions should be investigated. Are US logistical organizations and resources capable of effectively supporting standard US and nonstandard foreign government requirements when one or both countries are involved in a war? How do nonstandard parts affect the unit costs of standard parts, sources of supply, and the ability of the US to replenish spares, especially during wartime? Are the costs of managing and distributing nonstandard parts commensurate with the fees charged foreign governments? Are nonstandard part stock levels adequate to meet a foreign country's (or countries') real or perceived threat? Over what time span?

Topic: The Foreign Military Sales (FMS) Process: US Policy Versus Practice

Research Need: Many unique and unprecedented FMS arrangements and agreements are made between the US and foreign governments which are not addressed in the Defense Acquisition Regulation (DAR), Department of Defense (DOD) Directives, or policy guidance. The reason for these widely varying FMS arrangements and agreements; the environments that generate them; their impact on foreign and national policy objectives; and DOD acquisition management, as well as their legality within existing laws, need to be researched and documented.

Objective: Evaluate the need for changes in existing laws and policies that effect FMS and in developing new policy that more closely reflects the environment.

Topic: Administrative and Judicial Forums for Foreign Military Sales (FMS) Acquisitions

Research Need: In relation to constitutional, statutory, and regulatory law, research is needed to provide procedures for effective breach remedies and a judicial forum to review claims arising out of FMS.

Objective: To study and analyze the merits of:

- a. An Armed Service Board of Contract Appeals (ASBCA) empowered to hear bid protests when direct-cite (foreign) funds are used, and
- b. In direct-cite contracts, recognize a single federal district court (preferably the Federal District Court for Washington D.C.) as the forum for judicial review of administrative board decisions.

The study should also include proposed changes to Defense Acquisition Regulations (DAR), existing laws, and Department of Defense directives.

Topic: Liability of the U.S. Government under Foreign Military Sales (FMS) Contracts Executed Pursuant to the Arms Export Control Act (AECA)

Research Need: For many FMS programs, contracts are executed direct-cite funding only upon receipt of a foreign customer's "dependable undertaking" to pay the full amount of the contract. There are growing concerns that the US would be liable if the foreign country defaults and that the Executive Department lacks the authority and the funds to pay the contractor without litigation. This situation is cumbersome and unsatisfactory to the US and its FMS contractors. Additionally, the language of the unique direct-cite funding procedures for FMS appears to unduly limit the actions the US may take to protect itself or the customer nation after the customer nation defaults. In that event, the only possible avenue available may be termination without recourse to other appropriate business solutions.

Objective: Research is needed to develop alternative methods to the

existing procedures and make recommendations for statutory changes to the AECA to correct the confusion.

Topic: Department of Defense (DOD) Manpower Ceilings for Support of Foreign Military Sales (FMS) by US Government Organizations

Research Need: Management of contracting and logistics to support our military allies is growing in importance and volume. This increasing volume of FMS programs requires the support by a large number of military and civilian personnel in various activities including contracting, program management, and materiel management. We presently do not have an effective means to assess the impact of FMS support on DOD manpower. The current manpower ceilings and civilian high grade limitations act as a restraint to providing support to both FMS and domestic programs.

Objective: To identify and evaluate the impact of FMS workload on Air Force organizational manning.

Topic: Foreign Government Involvement in the US Acquisition Process

Research Need: Foreign governments and their national firms are becoming more involved in the Foreign Military Sales (FMS) acquisition process itself which was previously performed by Department of Defense (DOD) and US contractors. Unprecedented business arrangements have impacted laws, regulations, organizational structure, and the Air Force acquisition and contracting process.

Objective:

- a. Investigate relationships between foreign governments and their national firms.
- b. Identify common foreign international and cooperative business practices and arrangements.

c. Determine best types of contracts for various programs such as offset and coproduction agreements; and

d. Apply the above findings to improve current DOD and Air Force cooperative international arrangements.

Topic: Aspects of Commercial Channel Foreign Military Sales (FMS) Versus Department of Defense (DOD) Channel

Research Need: With the exception of sales to NATO and a few other designated countries, all sales of defense items over \$25 million must be handled through the DOD instead of directly through commercial channels. Because of this, the DOD may find it difficult to obtain certain compensations for the tremendous FMS workload now being handled (e.g., exemptions from manpower ceilings for personnel involved in FMS activity).

Objective:

a. Determine the feasibility of commercial logistics support to include:
(1) assessment of contractors' willingness to provide direct service and
(2) comparison on such matters as price and availability.

b. Compare Air Force cooperative logistics support to support provided by commercial corporations on large scale aircraft or equipment systems.

c. Analyze foreign buyers' viewpoints on availability, price, delivery, and variances in policies between Government and commercial sales.

d. Identify difficulties in switching from FMS to commercial sales.

e. Identify the differences in impact of FMS or commercial sales on the defense industrial base.

**TECHNICAL MANAGEMENT
RESEARCH AREA**

Objective: To provide the functional acquisition manager with the knowledge and tools needed to increase the effectiveness of functional experts on

major system acquisitions. Research efforts including but not limited to the following technical disciplines: engineering, contracting/manufacturing, integrated logistics support, legal, technical data, configuration management, test and evaluations; and program/project control are of concern in this research area. The focus of this research area is upon the technical functions such as laboratories, engineering, and tests that must support a variety of programs.

Background: Program management is central to the acquisition of weapons systems in the Air Force. The system of technical/functional disciplines exists to assure that technical knowledge is available to support weapon systems that are in all phases of the weapon system life cycle--operation, production, development, or concept formulation. In addition, these technical/functional disciplines have a responsibility to assure the development of a leading edge technology base for possible application to the next generation of weapon systems. Technical managers outside the mainstream of weapon system program management need to balance their responsibilities between advancing the state-of-the-art within a given technical area and providing problem-solving support and technical assistance to specific weapon system programs. On the one hand, for example, they are responsible for managing a specification and standards program for the entire industrial base, and, at the same time, they are responsible for performing specification tailoring for a given weapons system. Where a program manager needs to balance resources applied to a single program, the technical/functional manager needs to allocate resources among many presently on-going programs and possible future programs. Over emphasis upon current programs and technology can lead to a severe shortage of technology and technical management skills in the future. Research into this area can lead to improved methods for technical management. Some of the research questions are: how can technical resources be allocated between near and long term needs; how can repositories of "technical lessons learned" be managed; what management information systems are required by technical managers; and what organizational structures are appropriate to facilitate project support, minimize conflict, and assure long term resource availability?

Topic: Application of Formal Uncertainty and Risk Analysis Techniques During Systems Acquisition

Research Need: Department of Defense and Air Force acquisition management directives require that risks be continually addressed throughout development of major weapon systems and that risks be minimized before the decision is made to enter full production. However, no formal guidance exists to help acquisition managers conduct formal risk analysis during acquisition. Management tools such as Cost/Schedule Control Systems and network analysis are in common use, but the concepts often fall short of management's decision-making needs and fail to address technological uncertainty in programs.

Minimizing risk requires a similar or proportional reduction of technological uncertainty about a system. Technological uncertainty before and during development is a major factor when cost growth is considered. This uncertainty and related risks should be addressed at each milestone and/or major decision point during development and before full production is approved. Techniques such as DELPHI can be used to address qualitative concerns and their attributes, assess technological uncertainty, and formulate a baseline for measuring risk during development.

Other techniques such as portfolio analysis, bayesian and classical statistics, network methods, and/or combinations of such methods can be used to formally track and measure uncertainty and risk. Research needs to be conducted to identify and catalog formal uncertainty and risk analysis concepts and translate those concepts into practical guidance for acquisition managers who continually face decisions that involve technological uncertainty and risk.

Objective: The objective of this project is to develop a handbook for use by acquisition managers and their staffs to assess technological uncertainty and analyze risk associated with weapon system development.

Topic: Software Data Item Development

Research Need: Avionic (i.e., Aviation Electronics) software development has been an area that has largely escaped normal managerial controls. Frequently, actual software costs exceed the initial budget by 100%, and the time to reach operational status is often twice as long as scheduled.

It is difficult to estimate the effort required to produce software, especially avionic software. The software development process is not well understood, and the numerous factors affecting the development leaves decision makers with a limited ability to effectively monitor and direct the process.

Billions of dollars are being spent annually by the Department of Defense for an Embedded Computer System (ECS), hardware and software. However, a search of the literature uncovers no formal design method to insure that a given hardware/software mechanization is near optimum for either a general or specific application.

Another recurring problem is that contractors are over-optimistic in their estimates of system cost, performance, and delivery date and make contractual commitments based on those estimates in order to win program awards.

Program managers should be provided with useful tools to increase their confidence in the contractor's proposal, increase their awareness of software development, and increase their control over the actual development progress. A clear description of the key decisions and supporting factors of these decisions to control the development, definition, and acquisition of avionics software is needed.

Objective: This research will:

a. Develop proposal evaluation criteria and contract terms and conditions aimed at fostering realistic contractor cost, performance, and delivery date estimates.

b. Develop a set of guidelines for monitoring and managing progress of software development.

c. Develop a method to set and describe milestones and measure their percent completion on a program.

d. Attempt to describe incentives to increase the effectiveness of software development control.

Topic: Value Engineering

Research Need: Value Engineering (VE) provides the tools for reduced acquisition and life cycle costs, improved productivity, increased standardization, and conservation of resources. However, VE receives little management attention and seldom reaches its potential in accrued benefits. Either the current VE program or its application by management is inadequate.

Objective:

a. Determine why VE is not realizing its full potential and what changes should be made in the program to increase its effectiveness.

b. Determine whether VE clauses can be effectively managed to prevent increased research and development (R&D) budgets.

Topic: Improved Usage of Formal Government Data Bases

Research Need: An AFBRMC sponsored study reviewed the equipment selection decision process in weapon systems acquisition. Specifically, the study asks how do Air Force managers determine whether to design new equipment or to use previously developed equipment. An important segment of the decision process is the source of information used for the decision. It was found that "use of information sources in the decision process was inversely related to the formality of the source." The least important information sources were formal Government data bases (i.e., Government Industry Data Exchange and Defense Documentation Center). The most important information sources were gained through personal experience and contact (e.g., specialty engineers and contractors).

Why aren't formal data information sources in the equipment decision process? What are the major problems? Perhaps these data bases were not designed for this particular decision process. What changes would be required to improve the use of formal data bases? Would the potential benefits, if any, of changing the system be worth the investment cost? How could the system be kept up-to-date on an efficient and effective basis?

Objective: To determine the reasons why formal data bases are normally not used when researching previously developed equipments, and based upon the findings, to determine a reasonable course of action to follow.

Topic: The Distinction Between the Equipment Design Selection Decision and the Source of Equipment

Research Need: An AFBRMC sponsored study indicates that much confusion exists between two different aspects of the acquisition process: (a) the determination whether to design/develop new equipment or use previously developed equipment and (b) the determination as to who will provide the equipment in the contract process (i.e., will the equipment be supplied by the contractor (CFE) or by the Government (GFE)). Eighty percent of the Aeronautical Systems Division (ASD) personnel surveyed in the prior study believed the two decisions to be the same thing (i.e., new design is CFE; previously designed is GFE). In a two-by-two contingency table, this leaves two empty sets. Both empty sets are feasible and may be desirable (e.g., contractors selecting previously developed equipment to satisfy their internal requirements). Why does so much confusion exist? Is it a matter of terminology or of greater substance? What are the key factors that differentiate the two decision processes? How can this be communicated to appropriate Air Force personnel?

Objective: To clarify the distinction between the equipment design selection decision and the source of equipment (CFE versus GFE).

ACQUISITION LOGISTICS

RELIABILITY MANAGEMENT RESEARCH AREA

Objective: To realize system/equipment reliability that minimizes life cycle cost (LCC) and achieves the required level of system effectiveness.

Background: Reliability is one of the most important characteristics of Air Force equipment. Reliability affects operational readiness, inventory levels, acquisition quantities, and maintenance resources. The technical, business, and logistics dimensions of reliability are important to the acquisition process. The technical dimensions must consider the design, test, and prediction factors which impact upon demonstrating weapon system reliability. The business dimension deals with the cost/benefit analysis for reliability improvement, contractual specification for reliability, and the administration of contractual reliability requirements. The contracting technique of reliability improvement warranty (RIW) is being introduced to improve system reliability. The logistics effects dimensions are concerned with inventory/supply management, maintenance, and transportation considerations.

There is an important need to reduce support costs for military systems to levels which are consistent with funding limitations. The dimensions discussed above are important parameters of system life cycle cost and operational effectiveness, and they can provide fruitful areas for research.

Several of the general research goals in this area are:

- a. Identify the appropriate, valid reliability prediction models for application to Air Force systems acquisitions.
- b. Describe the causes of reliability growth and how these causes can be used in the structuring of incentives to yield reliability improvement.
- c. Identify a methodology that can be used to identify equipment which should undergo redesign to improve reliability.
- d. Describe information and administration systems required to effectively manage systems reliability and how these vary for warranty and non-warranty situations.

Topic: Reliability Improvement Warranty Evaluation

Research Need: The commercial airline industry has long used warranties for acquisition of equipment (especially avionics). This experience led to the use of a "Failure Free Warranty" in the late 1960's and, more recently, the Reliability Improvement Warranty (RIW) concept in the early 1970's. The Air Force is now using the RIW concept on a test bases for selected systems. Enough field experience is being realized in the Air Force that a current evaluation of the benefits and costs of RIW application is merited.

Objectives: Evaluate the recent performance of RIW's on DOD contracts. Make recommendations concerning their continued use and any changes in the guidelines governing their use. Parameters to be considered in RIW evaluation may include:

- a. Field administrative practices for RIW programs;
- b. Reliability growth - mean time between failures guarantee;
- c. Simplicity/complexity of contract terms;
- d. Review levels and decision authorities;
- e. Requirements for contractor reporting;
- f. Inventory levels and throughput/turnaround time;
- g. Warranty periods;
- h. Field representative failure reports;
- i. Packaging and transportation;
- j. Technical order requirements;
- k. Exogeneous effect of engineering changes; and
- l. Potential problems in transitioning from warranty to non-warranty environment, such as technical manuals, provisioning, support (test) equipment, and training.

Topic: Air Force Reliability Personnel

Research Need: A recent BRMC reliability (and maintainability) study suggested that one probable weakness in Air Force reliability programs is the availability, training, and motivation of working level reliability personnel. A comprehensive survey of reliability personnel is desired.

Objectives: To sample appropriate reliability personnel such as those identified with R&M specialties and/or graduates over the last decade of the Air Force Institute of Technology and other reliability programs. Such a survey would identify such factors as:

- a. Specific prior training in reliability and its perceived adequacy for subsequent assignments.
- b. Nature of subsequent assignments.
- c. Perception of career opportunities in the reliability field (and actual history).
- d. Effective use of trained personnel.
- e. Identification of roadblocks to effective performance.
- f. Understanding of reliability at managerial levels.
- g. Managerial level support of reliability specialists' initiatives and decisions.

Topic: Reliability Program Funding and Scheduling

Research Need: A recent AFBRMC reliability (and maintainability) study reported some consensus among leaders in USAF reliability management that reliability funding was both too little and too late (and applied inefficiently). An in-depth study of the reliability history in specific programs is indicated to support or refute these feelings.

Objectives: To develop case studies of the reliability activity within selected acquisition programs. Aspects studied would include: (a) funding and schedules recommended and approved; (b) staffing levels, qualifications, and reporting dates planned versus those experienced;

(c) perceptions of reliability and command personnel regarding actual and potential influence of reliability activity on the program; and (d) realistic assessment of benefits (if any) that should have accrued had the reliability program followed along ideal lines.

Topic: Reliability Growth

Research Need: Reliability should be expected to improve during the development and early deployment of a new system. Ability to predict the extent of this improvement is important in cost-effective achievement of reliability goals.

Objective: Develop better understanding of reliability growth, including:

- a. Concise expression of the nature and causes of reliability growth.
- b. Identification, comparison, improvement, and validation of models of reliability growth.
- c. Guidelines for taking advantage of reliability growth in managing system development.
- d. Relationship of normally expected reliability growth to incentives established for reliability improvement.

Topic: A Comparison of Commercial versus Government Approach to Use of Warranties

Research Need: A need exists to get a better understanding of the differences in approach used by commercial concerns in obtaining warranties on items they procure. The Defense Acquisition Regulations (DAR) provisions on Warranties (Section 1-324) contain guidance on the use of Correction of Deficiency and Warranty clauses for supplies and services, but except for acquisition of standard commercial items where acceptance of a commercial warranty may be appropriate, the DAR guidance does not discuss the "commercial world" concept of warranty coverage.

Objectives: Examine the experience of commercial airlines in obtaining warranties on aircraft and equipment installed thereon, including engines and avionics equipment. Obtain answers to the following questions:

a. What type of commercial warranties would be applicable to Government acquisition of major items like aircraft, engines, and avionic equipment?

b. What cost do the commercial airlines incur for their warranties?

c. What experience do the commercial airlines have in regard to enforcement of their warranties?

d. Is it realistic to equate military aircraft usage with that of commercial aircraft?

e. What differences, if any, exist in the way warranties are administered in the commercial world versus that of the Government?

Recommend for Air Force consideration specific language to incorporate into the DAR and (where appropriate) other documents that can be used to implement appropriate warranty coverage.

Topic: Reliability Contract Requirements

Research Need: Reliability program requirements may be written into contracts by specifying compliance with certain military specifications and data items. Often these contract requirements are included without real understanding of the cost to the contract or the benefit to be gained in terms of better design, performance, logistics supportability, and life cycle cost.

Objective: Develop a methodology on when and how to apply reliability program requirements to contracts. Find means to tailor the scope of the reliability program to size and other attributes of the acquisition program. Point out areas where military specifications and Data Item Descriptions (DIDs) can be improved. Provide cost data to aid in the general decision-making process.

**QUALITY ASSURANCE
RESEARCH AREA**

Objective: To identify quality assurance methodologies that effectively and economically contribute to customer satisfaction in the acquisition environment.

Background: With the exception of needs having to do with quantity and location, the satisfaction of customer needs is the objective of acquisition quality assurance. In a military environment, this satisfaction contributes directly to force readiness and ultimately to mission effectiveness. In a broad context, two dimensions of quality that contribute to customer satisfaction are design quality and conformance quality. In system acquisition, design quality is normally achieved through the research, development, test and engineering (RDT&E) process.

Supplementing the RDT&E process and continuing throughout the disposal phase of a weapon system is the traditional application of quality assurance which includes the use of quality control and inspection techniques concentrating upon conformance quality. Measures of quality over extended time periods are accomplished through reliability disciplines. Although basic contracting quality assurance policies are prescribed by the Defense Acquisition Regulation (DAR) and functional directives, the approaches/strategies for quality assurance used by acquisition managers vary depending upon the nature of the contract.

Typical categories of contracting are: (1) research, development, test, and evaluation (RDT&E) of major weapon systems; (2) production of major weapon systems; (3) replenishment acquisition of components and piece-parts; (4) renewal, modification, or refurbishment of major systems/subsystems; and (5) the acquisition of services and support functions. In any selected acquisition environment, six primary elements of acquisition quality assurance need to be balanced: (1) the management of internal quality assurance programs and resources--staff, program office, contract administration office, and maintenance; (2) the selection of contract quality requirements--product and management; (3) managing interface disciplines--reliability, system safety,

manufacturing, configuration management, etc.; (4) the evaluation of supplier/contractor performance; (5) the measurement of customer (i.e., using command) satisfaction; and (6) the acceptance of products/services including the identification of critical characteristics which require direct Government inspection/verification.

Topic: Selection of Quality Assurance Management Information Elements

Research Need: Quality assurance (QA) has customer satisfaction as an overriding goal. This goal requires the definition of several key factors:

(a) Who are the customers in a large scale, complex organization such as the Air Force?

(b) What measures are:

(1) Needed, and

(2) Available, obtainable, or creatable to evaluate the level of customer satisfaction/dissatisfaction with the product?

(c) Who, in position of authority, needs the information in order that corrective action can be taken?

(d) What levels of dissatisfaction require the establishment of economical corrective action programs?

These QA management information needs vary according to the development status of the item, the number of customers and producers, and the management environment in which the QA decisions are being made. Although the formal literature cites, in general, the type of information to be used in the management of the QA function, these have not been synthesized and integrated with the Air Force acquisition context.

Objective: To identify practical, significant information elements necessary to accomplish QA management for major system, subsystem, component, and service acquisitions during development, production, and use.

**LIFE CYCLE PERFORMANCE EVALUATION
RESEARCH AREA**

Objective: To realize desired system/equipment performance effectiveness levels while achieving Design-to-Cost (DTC) and Life Cycle Cost (LCC) goals. The sub-objectives are twofold: first, to develop and/or evaluate the various methods and techniques to achieve and reduce design and life cycle support costs (e.g., reliability improvement warranty) and second, to improve methods to identify, measure, and evaluate primary LCC drivers during the acquisition process.

Background: The purpose of DTC is to maximize system performance subject to given cost constraints (or cost target) with stated quantity and schedule requirements. The establishment of the cost target is done early in the acquisition process and requires trade-offs among cost, performance, schedule, and quantities for alternative system design concepts and alternative preliminary designs.

The objective of LCC is to reduce ownership costs by considering both acquisition and logistics support costs in decisions made during acquisition. Three LCC needs must be emphasized: (1) consider operations and support (O&S) cost in the design process, (2) generate management awareness and visibility, and (3) implement O&S in the contract. In order to realize the needs listed above, we need to improve techniques to measure and evaluate LCC.

The availability and accuracy of cost data normally increase from the time the requirement originates. Therefore, it may be necessary to use different techniques to evaluate LCC during various time frames depending on the availability of LCC information. Early in the cycle, it is desirable to identify the cost drivers and make trade-off decisions between the requirement and the LCC. As the requirement becomes firm, LCC becomes more of a criteria to evaluate the best source among competing firms. Later in the cycle, it is necessary to incorporate the factors which indicate the need for equipment repair or replacement (e.g., flying hours, operating hours, landings, age, and extent of exposure to environmental conditions). More

knowledge is needed of the changing nature of data requirements, cost drivers, and cost projection techniques if the LCC concept is to be of maximum assistance.

Topic: Organizational Implementation of Harmonized Design-to-Cost Goals

Research Need: Design-to-Cost is a management technique used to provide assurance that cost is an important decision parameter in the development and acquisition of defense systems. Optimally, the design-to-cost goal will be established based on the objective of minimum total life cycle cost for the system. Life cycle cost includes the total acquisition and ownership costs for the system. Acquisition cost includes development, test, and production cost elements. Ownership cost includes costs for training, operation, and support for the system. Due to situational variables, a variety of strategies are used to implement the design-to-cost concept. In some cases, the implementation strategy selected may result in the selection of acquisition cost goals that compete with ownership cost goals. Although research has yet to establish a clear relationship between acquisition cost elements and ownership cost elements, there is a need to establish a decision framework which causes acquisition cost goals and ownership cost goals to be harmonized when the implementation strategy for design-to-cost is selected. Economic models can be used to establish the quantitative harmony; however, these economic models need to be translated into a management system that considers variables of management structure, budgetary and fund control processes, and responsibility evolution in order to achieve optimal life cycle cost objectives.

Objective: Based upon the existing Air Force organization structure, describe a program management system for design-to-cost programs that provide for harmonized goals for acquisition and ownership costs.

Topic: Life Cycle Cost (LCC) Model Classification Guide

Research Need: The objective of LCC is to reduce ownership costs by considering both acquisition and logistics support costs in decisions made during acquisition. In order to accomplish this objective, it may be necessary to use many different techniques to evaluate LCC during the various time frames in the acquisition cycle and depending upon the availability of LCC information. Presently, there has been in the DOD a large proliferation of LCC models available for use.

Objective: The purpose of this research is to develop a taxonomy of LCC models that would consider the number, type, use, and validity of the various models presently available to Air Force managers.

Topic: Software Life Cycle Process Simulation

Research Need: Lack of reliable data on key cost factors of a software Life Cycle Process has hindered the development of a software cost estimating methodology simulation.

A working computer simulation model of the software development process is described in an Electronic Systems Division (ESD) Technical Report, "Cost Reporting Elements and Activity Cost Trade-Offs for Defense System Software."

Research over the past decade has failed to result in the development of reliable software cost estimating models. One reason for this failure appears to be the inadequacy of standard analytical techniques (e.g., regression) in defining a highly dynamic and complex process such as software development. A need exists to develop more sophisticated modeling techniques, such as process simulation.

The simulation might treat the software development process as a queuing situation in association with various computer program configuration items.

Objective: Develop a more accurate and sophisticated method to simulate software life cycle to improve life cycle cost (LCC) estimates for software systems.

INTEGRATED LOGISTICS SUPPORT RESEARCH AREA

Objective: To develop methods and techniques which will improve the overall logistics support of Air Force weapon systems.

Background: The integrated logistics support (ILS) concept is concerned with the definition, optimization, and integration achieved by systematic planning, implementation, and management of logistics support resources throughout the system life cycle. The concept is realized through the proper integration of logistics support elements with each other and through the application of logistics considerations to the decisions made on the design of the hardware system and equipment as a part of the system engineering process (AFP 800-7). In order for the ILS concept to be fully realized, the proper applications must be used during the acquisition process that can integrate the various support elements (test and support equipment, spares and repair parts, personnel and training, technical data, facilities, transportation, handling and maintenance). The overall goal is to develop systems that meet performance requirements and which can be supported economically throughout the life cycle. Research in this area will consider the improvement and validity of techniques such as logistics support analysis, life cycle cost models, logistics tests, design for maintainability, etc., which can help achieve our overall goal.

Topic: Reprourement Data Packages

Research Need: In the Air Force acquisition of a unique military system, the Air Force contracts not only for system hardware but also acquires important engineering data on the system. The engineering data has many purposes including contracting of

spares, modification kits, and engineering services. The Air Force has a policy directed to increase competition. A key element of any competitive effort is the availability of reprourement data. Such data is expensive and can be compromised in any financial trade-off made during the design and production of hardware. Inadequate guidance exists relative to the purchase of reprourement data packages. Often packages are procured but never utilized in a competitive situation. Inadequacy of the data procured, proprietary restrictions, design changes, etc., are some problems that result in sole source versus competitive procurements. A study is needed that will improve the methods for selection of the essential data and, if possible, reduce data costs.

Objective: Review and evaluate the present reprourement data management procedures to determine if the data contracted for is: (1) minimum essential, (2) usable (technically adequate), (3) actually used, and (4) worth the cost of preparing.

Topic: Hardened System Life Cycle Survivability Management

Research Need: Air Force systems are designed to survive exposure to nuclear effects. These systems survivability design characteristics must be assured throughout the operational life of the system. Preserving a system's designed-in survivability must be addressed and planned for during the entire acquisition cycle of the system. A road map describing the survivability characteristics, their support requirements, and proper maintenance should be developed and routinely included in the acquisition cycle regulations, manuals, and guides. In particular, Air Force Logistics Command (AFLC) must provide for the maintenance of design survivability of all systems during all phases of their support activities.

Objective: To develop a descriptive guide that provides instructions for AFLC and Air Force Systems Command (AFSC) to effectively interface on system survivability support requirements.

BUSINESS ENVIRONMENT

COST INFLATION RESEARCH AREA

Objective: To improve contractual methods and facilitate program budgeting techniques, effective planning, and contracting approaches for acquiring systems, supplies, and services during period of rapidly changing price levels.

Background: Air Force contracting Officers are responsible for making acquisitions that will meet defense mission needs through effective contracting methods. In today's economy, it has become increasingly difficult to meet mission support requirements while supporting stated Governmental policy of encouraging fair profits and economic growth. Inflation causes problems in both the acquisition planning process and the contracting process which must be managed effectively by the Air Force. Since current budgeting and contracting methods may not adequately deal with rapidly escalating prices, improved approaches need to be developed. Within the inflation spectrum, four interest areas have been identified: (1) the economics of inflation, including causes and the prediction of inflation rates; (2) the development, usage, and effects of Economic Price Adjustment (EPA) clauses; (3) the development and use of price indices; and (4) payment policy under terms of EPA clauses.

Topic: Economic Price Adjustment of Fringe Benefits

Research Need: Inflation continues to have a significant impact on Government acquisition programs. Research has been conducted to develop and implement contract clauses to aid in managing the adverse effect of inflation on contractors; however, recent changes in the economy have caused new concern about inflation. Research is needed to develop policies to cope with the cost changes of productive elements faced by contractors resulting from inflationary conditions.

Objective: The research would focus on identifying and analyzing the underlying causes of inflationary costs being experienced by aerospace contractors. It would be directed toward fringe benefits, pension plans, and other worker compensation costs.

Topic: Economic Price Adjustment (EPA) Based on Bureau of Labor Statistics (BLS) Versus Actual Contractor Costs

Research Need: EPA clauses are sometimes used in Government contracts to provide a method for sharing the risk of abnormal contractor input price fluctuations. The effective use of such clauses requires careful analysis of the expected behavior of productive factor input prices. Normally one of the national BLS price indices, Consumer Price Index (CPI) or Wholesale Price Index (WPI), will be used as a basis for adjustments to contract payments. If the actual prices experienced by the contractor differ greatly from the BLS index, windfall profits or unjustified losses may result. A technique based on using the lesser adjustment based on the BLS computed adjustment and the actual contractor price experience has been proposed. Properly applied, this technique should adequately compensate the contractor for any unanticipated price changes, as well as guard against windfall profits due to unexpected and unrelated BLS index fluctuations. Research is needed to investigate the feasibility of this technique, accurately describe its application, identify the information needed for proper implementation, and evaluate the impact of the technique.

Objective: Develop an assessment of the techniques for identifying the contract payments based upon EPA clauses. The evaluation should be conducted by comparing BLS index-indicated price changes and actual contractor cost experience.

Topic: Anti-Inflation Certification Requirement Impact Evaluation

Research Need: As the anti-inflation certification program is implemented, noncompliance can result

in withholding of contract awards and debarment from future awards. These actions and the certification process combined will present acquisition personnel with new challenges. These new requirements must be effectively and efficiently incorporated in the acquisition process. Particular emphasis should be focused on the direct impact on acquisition and contracting and the number of vendors available to the Government contracting process.

Objective: To provide a current policy assessment of the new anti-inflation program and assure that the effects of the program on the acquisition process are accurately documented.

Topic: Defense Acquisition Regulation (DAR) Threshold Indexing

Research Need: Numerous thresholds are set in the DAR and used to key certain contracting actions. For example, DAR 3-203.1 allows negotiation of purchases of less than \$10,000 under small purchases. If the small purchase is for less than \$500, an award can be made without competition if the price is considered reasonable. These thresholds do not reflect the constant real value in an inflationary economy. A study should be accomplished that would review all the present thresholds and determine the impact of applying to thresholds indices based on an acceptable price index to permit the thresholds to reflect real values in today's environment.

Objective: To identify the impact of specific thresholds used in the current DAR and evaluate the impact of applying a price index adjustment to these thresholds.

**IMPACT OF SOCIO-ECONOMIC PROGRAMS
RESEARCH AREA**

Objective: To analyze the socio-economic aspects of DOD acquisition with particular attention to the impact of socio-economic and special interest programs on the DOD budget.

Background: Quantitative analysis is meager in studies concerning the

additional cost and/or time required to comply with laws and executive orders that pertain to various socio-economic objectives not directly related to the military mission of the Air Force. Development of figures associated with the support of such programs would assist the Air Force in determining the net mission-related purchasing power of fiscal year budget dollars. In this regard, methodology to be used in the study of socio-economic programs must be addressed. Specifically, obtaining accurate data on man-hours expended, costing administrative effort and/or delay, and devising a method of keeping current on actual prevailing local usage rates (as opposed to Department of Labor furnished rates) are subjects requiring research. The specific socio-economic programs involved are:

- a. Small Business Set-Asides.
- b. Section 8(a) Awards.
- c. Davis-Bacon Act.
- d. Service Contract Act.
- e. Equal Employment Opportunity.
- f. Labor Surplus Area Set-Asides.
- g. Buy American Act.
- h. Balance of Payments Program.

Topic: Impact of Freedom of Information Act on Air Force Acquisition

Research Need: The Freedom of Information Act (FOIA) is having a direct impact on Air Force acquisition and contracting. The Air Force requires adequate disclosure of proposal information and active participation by contractors in submitting proposals to meet its contract process needs. The FOIA affects contractors' willingness to provide information and actively seek Air Force business. Air Force requests for proposals may not clearly present the current Air Force policy concerning FOIA.

Objective: To provide a complete explanation of the procedures used by the Air Force to manage the information provided by contractors in solicitations. The study should also clearly identify the acquisition and contracting problems that have resulted from

the FOIA and suggest ways to improve present practices to alleviate the problems.

Topic: Protection of Industrial Breakthroughs

Research Need: Effective source selection and new technology application make it necessary for the Air Force to obtain the latest industrial techniques and products from contractors. These products and techniques are usually proprietary and it is very important to the contractor that they be protected. The Government needs to develop a consistent, credible method to protect this type of information.

Objective: Research studies on this topic will address the problem of protecting contractor/proprietary information. In order to improve our ability to protect contractors competing for Government contracts, it will be imperative that present policies and practices be evaluated. Research can provide wider dissemination of good practices, and it can also identify those practices and policies that cause the most severe problems. Research will include evaluation of the Freedom of Information Act, which directly impacts this problem of information security.

Topic: Industrial Impact of Environmental Programs

Research Need: American industry is being forced to alter its production processes and facilities in order to comply with environmental quality criteria which are being or have been established by the National Environmental Policy Act (NEPA) and the Occupational Safety and Health Act (OSHA). Management is curtailing production, discontinuing production of some products, making a shift in product mix, and making large capital expenditures for pollution control processes in order to meet these federal requirements. As a customer for large volumes of certain products, the Air Force needs to know the impact of these environmentally-related availability and cost factors on acquisition costs.

Objective:

a. Identify Air Force suppliers and market segments who face or expect to encounter significant environment-related production impact on product availability and price.

b. Identify and estimate impact of selected suppliers' production changes on the Air Force acquisition process.

c. Estimate and/or document cost in terms of lead time, transaction costs, higher prices, substitute products, etc., of identified price and availability changes.

Topic: Responsibility for Contractor Certification of Small Businesses

Research Need: Before awarding a contract to a small business firm, the Department of Defense (DOD) contracting officer must determine that the business is capable of completing the work. In those situations where doubt of competency exists, the Small Business Administration (SBA) can issue a Certificate of Competency under Defense Acquisition Regulation paragraph 1-705.4. It has been suggested that the DOD should transfer a portion of the contract responsibility to the SBA. This action is similar to that taken under the 8(a) set-aside procedures where we contract with SBA as the prime contractor. Under current procedures, SBA retains little responsibility for the performance of the contractor they have certified. Proper responsibility and the effects of the present policy need to be evaluated.

Objective: To evaluate the methods being used and identify the criteria applied to small businesses when the certificate of competency is awarded. To assess the appropriateness of this present method and criteria and make recommendations for changes if justified.

LEGAL SYSTEM INFLUENCES RESEARCH AREA

Objective: To identify, document, and evaluate the extent and directions which the legal system (e.g., statutory law, common law, court decisions, and rulings by the Comptroller General and the Armed Service Board of Contract Appeals (ASBCA)) has shaped the acquisition and contracting process.

Background: Every aspect of the contracting process has been, to varying degrees, specified, defined, and interpreted through legal processes before various tribunals. While the precedence and propriety of extensive legal influence over the contracting process are not contested, the pervasive nature of the legal role and its interrelationship with decision making, where acquisition matters are involved, are subjects requiring additional understanding. A number of concerns involving both pre-award and post-award policies and procedures may be addressed under this research area.

Topic: How to Make Termination for Default Actions Stick

Research Need: Many contract termination actions initiated because of contractor default are subsequently executed at the convenience of the Government. This conversion of termination actions from default to convenience results in the waiver of Government rights to claim recoupment for damages resulting from contractor failure to fulfill contractual obligations.

Objective: Identify terminations for convenience which were initiated as default actions. Those actions so identified should be researched to determine the reasons the conversions were made. After reasons are identified, formulate criteria and procedures to avoid future occurrences.